

Bulletin; Gulf Biologic Station
no. 14, 1909; no. 15, 1910

GULF BIOLOGIC STATION

CAMERON, LA.

BULLETIN No. 14

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Habits, Life History and Economic
Value of Doves

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Young Waxwings, *Ampeles Cedrorum*

BY

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THE NEW ADVOCATE, OFFICIAL JOURNAL
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A Few Notes on the Life-History, Habits, and Economic Value of Doves.

By WM. H. GATES.

The forces of nature, as has been aptly said, are swung in a balance. The balance is indeed delicate, and is quickly turned whenever an advantage, no matter how slight, is weighed against a no-advantage, or disadvantage. Yet it is the turning and the very gradual readjustment to an equilibrium which marks the epochs in the life histories of all animals. Civilized man, in order to satisfy his own wanton desire, has deliberately destroyed the swing of the balance, time and again, and left his progeny to suffer the results till readjustments could take place. "We care only for ourselves and our children," has been the unconscious motto of generations. We of the present generation condemn our ancestors for the reckless wastefulness of the resources of nature, which to us are a treasure; while, unthinkingly, we may be guilty of the same offense. The extinction of plants and animals may, in some cases, be laid to an ignorant assumption that man cannot possibly destroy the enormous numbers that are produced annually. The fisherman, as he sails the vast expanse of water, cannot realize that, with favorite fish swimming everywhere, the hand of man can possibly reach out and take up practically every one. Not till too late does he see that they are gone, and he must turn elsewhere to provide himself with bread.

Where are the millions of bison that roamed the American prairies? Reduced to a few small herds, and how long would they last, if they were not most stringently guarded and protected? Other cases of lawless extinction are abundant. What the market demands, man is prone to supply through hope of pecuniary gain. The purpose of the demand, whether for food, pleasure or comfort, matters not, so long as the price is forthcoming. Fabulous prices have been offered by milliners for

the plumes of birds that were almost extinct; and even scientific institutions offer amounts for rare specimens that will induce a man to take great risks.

W. E. D. Scott in the *Auk*, Vol. IV, 1887, gives a terrible account of the wiping out of the beautiful American Egret. Years ago, in Florida, there were prairies white with the birds, and even many of the adjoining islands were "alive with Egrets." But what do we find now? Miles and miles of shore with perhaps a single solitary bird. These birds were killed by the hundreds of thousands annually; and the same may be said of its smaller cousin, the Snowy Egret, which, at one time abundant all through the Gulf States, is now all but extinct. Here the "bull's-eye" for every hunter was the beautiful bunch of snow-white aigrettes.

F. M. Chapman ("Birds of Eastern North America") states: "I have heard a plume hunter boast of killing 300 herons in a rookery in one afternoon. Another proudly stated that he and his companions had killed 130,000—Heron, Egrets and Terns—during one winter."

But perhaps the most striking example of bird extermination is that of the Passenger Pigeon, *Ectopistes migratorius*. At the time of Audubon, the number of these birds seemed infinite. A breeding ground reported in 1876, near Petoskey, Mich., was 28 miles long and averaged 3 to 4 miles in width, containing upward of 100,000 acres; and from which it was estimated that in 1878, 1,500,000 dead birds and 80,500 live ones were shipped by rail, and probably an equal number by water. This is the largest known nesting ground, although others of large area have been recorded. Wilson, in 1808, estimated that a flock observed by him near Frankfort, Ky., must have contained at least 2,230,272,000 individuals. Prof. H. B. Roney estimates that in 1878 the number of pigeons destroyed in Michigan amounted to 1,000,000,000. These figures may be somewhat exaggerated, yet it certainly shows that immense numbers were destroyed. In 1861 the matter of bird protection came before the Ohio legislature, and the plea was made that the Passenger Pigeon needed no protection. "The Passenger Pigeon needs no protection," they claimed; "wonderfully prolific, having the vast forests of the North for its breeding grounds, traveling

hundreds of miles in search of food, it is here to-day and elsewhere to-morrow, and no ordinary destruction can lessen them, or be missed from the myriads that are yearly produced."

This species was formerly abundant over the forest region of Eastern North America, being found from the Gulf of Mexico to Hudson's Bay; and by offering a plentiful supply of food, which could be easily gotten from the enormous breeding colonies, roosts and flights, they were accordingly slaughtered by the millions and shipped to the big markets by the carloads. Wilson's account of the killing of these birds is interesting: "As soon as the young were fully grown, and before they left their nests, numerous parties of the inhabitants, from all parts of the adjoining country, came with wagons, axes, beds, cooking utensils, many of them accompanied by the greater part of their families, and encamped for several days at this immense nursery. Several of them informed me that the noise in the woods was so great as to terrify their horses, and that it was difficult for one person to hear another speak without bawling in his ear. The ground was strewn with broken limbs of trees, eggs, and young squab pigeons, which had been precipitated from above, and on which herds of hogs were fattening. Hawks, buzzards and eagles were sailing around in great numbers, and seizing the squabs from the nests at pleasure; while from twenty feet upward to the tops of the trees the view through the woods presented a perpetual tumult of crowding and fluttering multitudes of pigeons, their wings roaring like thunder; mingled with the frequent crash of falling timber; for now the ax-men were at work cutting down those trees that seemed to be the most crowded with nests, and contrived to fell them in such a manner that in their descent they might bring down several others, by which means the falling of one large tree sometimes produced 200 squabs, little inferior in size to the old ones, and almost one mass of fat. . . . It was dangerous to walk under these flying and fluttering millions, from the frequent fall of large branches, broken down by the weight of the multitudes above, and which in their descent often destroyed numbers of the birds themselves."

But what is the result? These birds have long since ceased to be of any economical, much less commercial importance. They

are now considered of accidental occurrence in all but two or three states. Capt. Charles Bendire ("Life Histories of North American Birds") says: "It now looks as if their total extermination might be accomplished within the present century (19th). The only thing that retards their total extinction is that it no longer pays to net these birds, they being too scarce for that now, at least in the more settled portion of the country; and also, perhaps, from constant and unremitting persecution on their breeding grounds, they have changed their habits somewhat, the majority no longer breeding in colonies, but scattered over the country and breeding in isolated pairs."

The Mourning, Carolina, or American Turtle Dove, although never as abundant as its larger cousin, the Passenger Pigeon, has held its own better against the hand of man, principally on account of its more solitary nature; as they breed more or less in single pairs rather than in colonies. In Louisiana, at the present time, these birds are fairly abundant in all sections throughout the year, but especially after the migrants from the north arrive for the winter, which is during the last of September and the first of October. In the vicinity of Cameron, with but few exceptions, they are the most abundant of our resident birds; and this might also be said of other portions of the State. On that account, outside of their qualities as a game bird, they may be considered, from an economic standpoint, as of some value.

Doves are exclusively grain and seed eaters, although occasionally small insects are found in the crop; and birds kept by the writer have been seen eating ants, both large and small. This same grain diet is fed to the young, in which respect they differ from other seed-eating birds which feed their young almost entirely on insects till they are able to leave the nest, and often for some time after that.

Just one instance of economic importance as insect, as well as weed-seed destroyers, may be given in a few notes on the Nonpareil, *Passerina ciris*. This is a seed-eating bird in its mature state, yet the young are fed exclusively on insects till they are nearly two weeks old. At this time they would be able to care for themselves, and in many cases do. The bill is, however, still soft and they are unable to get at the kernel of seeds, which the adults do by cracking off the outside shell, and so the

old birds pay considerable attention to them after they leave the nest. If nothing happens to separate the family, the parents continue to feed the young for two or even three weeks after they leave the nest; and this food is largely insects, changing, however, gradually to a seed diet. Three young of this bird were found by the writer on June 3d, having evidently left the nest not more than a day before. The smallest of the three was captured and taken home, while the other two were watched daily, and notes kept of their development. The locality in which they were found consisted of a small group of low trees, covering an area of about 200 by 50 yards, and was separated by some considerable distance from any other trees. Although searched for, no other birds of that species were found in that vicinity, and since two young birds answering to the description of the first two, were seen nearly every day, it seems fairly certain that the birds watched were the same. On June 17 one of the birds had evidently started life alone, as on that date it was watched for nearly two hours and neither parent came near it. The other one continued to be fed up to June 20, or three weeks, lacking two days, from the time it had left the nest. The one taken to the house was fed for a week after being taken, although it would eat some of its own accord three or four days after it had been gotten. Beginning with June 10, it was fed on crushed bird seed, which it ate eagerly, and which was kept up for five days, by which time it was able to get at the kernel of the softer kinds by itself. In this case, caring for itself was forced on the young bird, and so does not represent a natural state of affairs, yet it shows that if necessary young birds will adopt the habits of maturity before they would ordinarily do so.

The purpose of these observations was to get some idea of the period during which the young birds are fed, and this means the time during which insects are consumed to a greater or less extent. Some idea, therefore, of their value as insect destroyers may be gotten when it is taken into account that each young bird consumes daily, during the first three or four weeks of its life at least its own weight, probably more, of insects, and that both the parents, while feeding the young, eat many of these injurious pests. Furthermore, since two, or even three broods are raised every summer, and the number per brood averaging four, it naturally follows that as insect destroyers these birds are of at

least minor importance. Their protection ought to be further encouraged since they have been reported as eating the cotton boll weevil; and, without exception, the farmers of Louisiana and other cotton-raising states will gladly do anything to diminish the numbers of this pest.

As stated before, the young of pigeons and doves are fed the same diet as that which the adults eat. The feeding is done by regurgitation, which act is practiced, among our birds, by only the Ruby-Throated Humming Bird, outside of the family *Columbidac*. A partial regurgitory act is found in the case of the Waxwings, *Ampelidac*, which, however, use their crop merely as a receptacle to carry food, and not as a place where food is stored to be partly digested. In their case insects are seldom carried in the crop, it being used for berries and other small fruit. Insects are, however, often fed to the young, yet these are carried in the bill. The berries that are carried in the crop are regurgitated singly and fed as such, instead of *en masse*, as the pigeons and doves do. In the feeding of the young, the bill of the squab is immersed down the throat of the adult, and the more or less fluid substance, known as pigeon's milk, is drunk together with the partly digested seeds as fast as it is regurgitated.

Although doves are well known in those localities where they are at all common, a few remarks about them in general may not be out of place. They are found in all of the states, in fact, extend, during the breeding season, from Mexico and Cuba northward to Quebec, Manitoba and British Columbia. It spends the winter from Southern Illinois and New York to Panama and the Greater Antilles. E. W. Nelson says that in the northern part of Illinois straggling parties are occasionally observed during the winter. In some states they are quite rare, this being especially true of all New England; while in certain localities of others they may be seen by the thousands. The breeding season naturally varies in the different parts of the country, being generally later the further north one goes. Rudolph M. Anderson (Birds of Iowa) states that "two or even three broods are raised during the season. I have found eggs in Winnebago county in all the months from April 30 to September 1." In Cameron parish, although eggs have been found from April 1 to September 1, and adults taken on September 9, 1909, contained eggs

in the ovary which would have been laid in a day or so, it is not likely that the birds, as a species, nest more than twice. Yet in many individual cases, three or more broods may be raised. The nests found late in the season are, however, in all likelihood, delayed second or even first broods, they being produced only as the result of the destruction of the normal brood. It is well known that with few exceptions birds will build a second or third time if their nests have been destroyed. This capacity for rebuilding and relaying is probably strong in doves, and the birds will nest several times if each successive nest is destroyed. Like most birds, they will not rebuild in the same place, nor often in the same locality. The writer has three records of where the same pair had rebuilt in the same tree, but this is not often the case.

As an instance of rebuilding and relaying, it may be interesting to cite the record of a Blue Bird, *Sialis sialis*, observed at Barkhamsted, Conn., during the summer of 1900, which, by having its eggs taken out one by one as they were laid, leaving one egg always in the nest, laid seventeen eggs in thirty-two days. When, at the end of this time the entire nest was destroyed it proceeded to build another in the same hollow of a tree, and then laid a set of four eggs, three of which were hatched. In this case there is definite proof that one bird laid twenty-two eggs under abnormal circumstances, whereas the number would naturally not have exceeded ten for the two broods. If data could be gotten in the case of doves, it would probably prove that the same is true, and that nests are built and eggs laid as often as they are destroyed, up to a certain limit. But since definite data is difficult to obtain on this subject, some light may be gotten by keeping the birds in confinement, and noting how many times they have a tendency to breed. It is likely that the natural habits will be closely followed if birds are kept in large out-of-door cages, such as are often used in keeping domestic pigeons.

In the vicinity of Cameron, La., the doves begin to nest about the first of April, although this date is variable from year to year, depending on the season. The bulk of them having laid by the middle of the next month. Incubation, so far as could be observed, lasts from 19 to 21 days, and begins as soon as the first egg is laid; which results in the hatching of the first egg from 24 to 36 hours ahead of the second. Of course all eggs will not

ordinarily complete their development in the same length of time, yet if incubation did not begin till after the second egg was laid the larger number of broods would hatch with no great difference in age. As it is, very seldom do the eggs hatch within a short period of time. This difference often becomes so marked that, at the end of a week's growth, the first one hatched will outweigh the other by a fourth, or even third, of its own weight. In the case of nests Nos. 29, 38, 43, 50, 61 and 90 (see table), where the difference in age was not over 36 hours, the young weighed, respectively, at the end of a week's growth: 49 and 29, 31 and 16, 53 and 29, 44 and 20, 38 and 20, 36 and 17 grms. 28 grms. = 1 oz.) These differences are, of course, exceptional, but by no means rare. Even up to the third week there remains a noticeable difference in size of birds from the same nest.

The young are born blind and naked, except for a scant scattering of down. Eyes open on the third or fourth day after hatching, yet sometimes development is delayed and they do not open till the sixth or seventh day, and the young do not leave the nest till they are over four weeks old. Examples of these retarded cases were found in nests Nos. 17 and 84, where the young were in the nest fully four weeks after hatching. At the end of two weeks, the normal young are able to fly a very little, and if forced to will even pick up food by themselves; yet they do not leave the nest until about a week later, and continue to be fed for some time after. Just how long they are cared for in the wild state, it would be difficult to determine, and may depend upon whether or not the adults are to breed again that season. Unlike the domestic pigeon, they do not lay a second time till the first brood is entirely out of their way. From the second to the fourth week the young grow and mature quite rapidly, apparently more so than during the first two weeks. Birds kept in the house gained, respectively, from 31 and 34 grams to 65 and 67 grams during the third week, and up to 95.5 and 96 grams during the next.

The element of fear is developed early, appearing before the end of the first week, while at the age of ten days it becomes so acute as to drive the young bird from the nest when approached too closely. This element of fear in all young birds is an extremely interesting case of a latent instinct lying dormant till necessity demands the function. The instinct lies undeveloped in the young, tending to keep them in the nest against outside

intrusion, till they are able, in some degree, to care for themselves. The development taking place early or late, according as the birds are more or less able to contend against their enemies, it may become wholly suppressed throughout the life of the individual, by association before its development with the natural objects of fear. Again it may appear late in life as the result of discontinuance of constant association. This may be clearly shown by taking a pet bird and placing it in a large cage hung in the orchard, where, if seldom visited, it will soon become as wild as any of its species, no matter how tame it may have been before.

Male birds show some signs of sexual maturity at the end of five weeks, when occasionally they may be seen "driving." Yet mating, which in all likelihood, lasts for life, does not take place till the following spring. About the seventh or eighth week there is a fanciful attempt to utter the cooing notes; at this age, however, they consist of but two notes, instead of the characteristic four syllables, "Coo-o-o, ah-coo-o-o, coo-o-o, coo-o-o," and resembles that of the adult much less than the crowing of the cockerel does that of the two-year-old. In less than two months, however, they are able to coo with the correct intonation and timing. The change of voice, which among domestic pigeons distinguished the so-called "Peepers" and "Squeelers" from the adult, takes place in doves about the seventh or eighth week, and is one from a high pitched peep to a low coo. A low, short coo is used as a warning note of apparent danger, and is taken up from one to the other when they are in flocks.

Young birds can be readily distinguished by the fact that the feathers are tipped with ash white, and are considerably lighter in color than the adult; there are also to be found many more of the black spots on the wings and back than on the old bird. Change in plumage takes place between the seventh and eighth weeks, when the ashy-tipped slightly grayish feathers are replaced by others of a rich brown color; this also being the winter plumage of the adult, while that of summer is lighter and of slightly pearl-blue tint. The small black mark below the ear, which is a distinguishing point in this species; the black line above the ear, not found in all birds, and the vinaceous bronzing, so characteristic of the males, do not appear till after the first



molt; while the bright iridescent patch on each side of the neck is the last of the adult plumage to be acquired. Most young birds shot in the early fall, can be recognized by the fact that, although the plumage is similar to that of the old birds, a few ashy-tipped feathers still remain where the bronze patches are to be.

The favorite nesting places are the more or less open woods, yet nests, in the vicinity of Cameron, have been found in the densest kind of foliage, namely, a tangle of wild grape vines. The nest is a loose platform of twigs situated in the more open branches of low trees, generally not more than ten feet from the ground, and occasionally even on the ground. F. M. Woodruff (Bull. Chi. Acad. Science) says that in areas around Chicago he has found it nesting on the ground in the higher fields. The foundation upon which it is usually placed is solid, a characteristic brought about probably by natural selection, since it has been noticed that the loose structure of a nest is inevitably destroyed by storms and winds, if located on a swaying limb; whereas, those nest that are built on a firm foundation will stand a surprising amount of rough weather.

Naturally a shy bird, and extremely so where hunted, they can be readily tamed; numerous instances being known where they have been kept in out-of-door cages, and where if turned loose during the day they will invariably return at night. E. W. Nelson (Bull. Eastern Iowa) states that "in many places this species becomes semi-domesticated, breeding in the trees in the yard and showing but little fear when approached." Nesting doves are easy to watch, even in the wild state, as at this time they are generally quite tame, and show but little signs of fear at being intruded upon; one can often get near enough to the old bird while brooding to almost touch her before she leaves the nest. The writer has several times stood within five feet of a nest and watched the young being fed. Two or three nests were found during the past season located at a considerable distance from any house, and where the birds certainly had no chance to become familiar with persons, yet here the female, while on the nest, appeared unconcerned at being watched, and could be approached to within a few feet. If young birds are taken before the instinct of fear has developed, and treated gently, they will

become absolutely tame, and will readily answer to a call or whistle. Furthermore, it is possible to raise them easily, as they are hardy and need but little care; they have to be fed but once or twice a day, and can be made to drink a soft mash, of their own accord, from the time they are twenty-four hours old.

On account of the crop capacity of doves, they are enabled to gather a large quantity of food before returning to the nest to feed the young; it also gives them an opportunity to wander and forage far and wide, thus covering a large territory. If food is scarce, or, as is the case in some places, nesting and roosting trees are far from desirable feeding grounds, the adult birds will travel far to get to where the food is abundant. Occasionally a bird shot in the neighborhood of the Gulf Biologic Station at Cameron during the fall of 1908, contained a crop full of rice, which food could not possibly have been gotten nearer than the Sweet Lake Farms, a distance of 12 to 15 miles. "as the dove flies."

The young are also well fitted to endure the life they are forced to lead by the habits of the adults. The crop capacity of young doves is enormous; up to the time they are three or four weeks old it is possible for them to hold over one-half of their weight of food in the crop. It is likely, in the state of nature, the young are not fed more than three times a day, generally but twice, and often not more than once, especially after the young get to be a week or so old and do not need to be brooded. The writer has watched many nests from 1 o'clock to 6 before seeing any trace of either of the parent birds. In some of these cases it was apparent that the young had been fed not long before, while in others there was no indication of it; showing that here the birds were not fed more than once in the afternoon, and the chances are good that some had not been fed at all, and others but once in the forenoon. Not long before sunset the old birds return to feed the young which will swallow to near the full crop capacity. The average of 78 weighings taken before and after feeding showed an increase of 36 per cent of their own weight. The maximum amount of food given, among those that were observed, was in the case of a squab that weighed 53 grams at 5 o'clock, before feeding, and at 6:15 swung the balance at 88 grams, showing that 35 grams of food had been taken, or a crop capacity of over 66 per cent of its own weight. This is unusual,

and due most likely to the fact that both parents had stuffed it, it being the only one in the nest. After the evening feeding, the old birds will sometimes go off, evidently to secure more food for themselves. This is especially true as the young get older; but more often the adult female will stay on the nest until morning, while the male goes off, returning at dusk, to take his roost near his mate.

Like Gallinaceous birds, doves enjoy basking in the sun. Early in the afternoon of any sunny day, if food is abundant enough to make them contented, they will gather in small flocks in an open sandy or dusty place; there, lying on one side, with wing outstretched, either on the ground or, for a few minutes, straight up in the air, turning themselves from one side to the other, they bathe in the sunshine. It also delights them, while bathing in water, to lie on one side and to stretch the wing of the opposite high above, as if to keep it from getting wet. They are most particular about the water they use for either bathing or drinking; preferring to travel miles, which with their strong, direct flight is but a matter of a few minutes, in order to get fresh water, while stagnant water may be everywhere near them. The writer has frequently seen them drinking and bathing in a pool of fresh running water which was far from either their roosting or feeding grounds; while he has never seen them bathe and but very seldom drink from stagnant ponds near which they feed all day long. Birds kept in captivity will bathe every pleasant day, if provided with fresh water, but if the same water is left to them from day to day they will never indulge. Water in which doves and pigeons bathe becomes covered with a milky scum and soon founs, and all water with any sort of a film on the surface is rejected, so long as any other is available.

The tendency to increase, or prolificness, is often a guide to the natural enemies of a species, and also to the length of life, great reproductive power indicating either short life or acute struggle against many contending agencies. Although there are no definite statistics as to the age that doves will live, yet the general opinion seems to be that they will live many years. A corroboration of this may lie in the fact that they are not very prolific, laying but two eggs at a time, and, as a species, not raising more than two broods a season. This low natural rate of increase may also lead to the conclusion that they have but few

enemies. However true this may be in other places, it cannot be said of the region around Cameron. During the time from May 15 to August 13, the writer recorded 111 nests, which were watched more or less closely. Of these, 80 were destroyed in one way or another, leaving but 28 per cent to live till they were able to fly, and showing that of the total number of nests that are built but few birds ever reach maturity. This loss is compensated, somewhat, by the fact that if the adults are not injured they will in all likelihood lay a second time. Furthermore this may be exceptional in this locality, but even then, the percentage cannot be very much higher than in other places, as the natural enemies are by no means superabundant in the nesting locality of the doves in this vicinity.

The nesting area in the vicinity of the Gulf Biologic Station is a patch of woods nearly a mile long and one-quarter of a mile wide at the widest, extending east and west. The preceding table represents observations made during the summer of 1908, on nests in this area. The location of nests was noted by marking off the area into a number of ranges which crossed a path running east and west. From these points a nest was recorded as so many paces east and so many north. Rounds were made nearly every day, but the entire area was not always covered. Nests were recorded as flown when the young disappeared after having attained a size at which they would be capable of taking care of themselves. It is possible that a few individuals, driven out prematurely, may escape their enemies and survive, yet such cases cannot be but rare, except in localities where the natural enemies are scarce.

What are the agencies, then, that the doves have to contend with? Are they the elements, or are they predacious animals? Heavy rains and winds may do their share, but it is small. On May 13, before records were kept of nests, a storm struck this region, in which 7.3 inches of rain fell in less than eight hours. This destroyed, by flooding, practically every nest of the common night hawk, of which there were a good many, and the adults were seen in flocks flying around all day long for several days after, till they had started to nest again, yet the writer did not notice that the number of nests vacated among the doves was any more than would have been under ordinary circum-

stances. On June 1 a heavy blow and thunder storm occurred, and during which 4.5 inches of water fell in less than an hour, and 6.2 inches in the next 18 hours. At this time there were actually less nests, of those under observation, vacated inside of 24 hours than there had been before, or were after; but here it is likely that those that were destroyed were the result of the storm and not of any other agency, as these would naturally do but very little damage during inclement weather. But very few cases were observed during the summer when it was certain that nests were destroyed by storms. In these cases the nests were more or less torn to pieces and the complete quota of eggs or young found under the trees. We may, then, conclude that doves can withstand rough weather, and that neither wind or rain of ordinary force, has much damaging effect on either nests, eggs or young birds.

What animals are there, then, that prey upon the eggs and young? Owls, Hawks, Jays, Skunks, Cats, Raccoons and Opossums are scarce in this locality, doing but very little harm, and so need no comment except that the Sparrow and Red-tailed Hawks at times become quite numerous, but usually not till late in the fall, after the breeding season is over. Yet in places where they do occur they will destroy their share of birds of all species, and must be considered, to a certain extent, enemies of game and other useful birds. But in their place there are snakes and rats in abundance. Of the former the Black King Snake is the most common. He is a greedy creature when he gets hungry, and will then gorge himself to repletion, after which he may lie idle for several days. On July 12 one was found coiled near a Mocking Bird's nest and seemed to be unconcerned amid the threatening cries of the old birds, and probably would have calmly devoured the entire contents of the nest if he had not been disturbed. One little bird, about ten or twelve days old, was just disappearing when the snake was captured. It was found, upon examination, that it had already swallowed one other bird from this nest, and had also raided a Red-winged Blackbird's nest but a short time previous, as it contained three eggs of that bird, in all of which the embryos were still alive. Twice this same snake has been caught in the act of destroying doves' nests. In the case of nest No. 40 the two young had been glutted when found; and No. 88, one egg

had been gorged while the other was just disappearing. Other common snakes, such as the racers and garters, must take their share of eggs and young, as they have been taken and found to contain eggs and remnants of birds. But, as stated before, they are not so common, and so do less damage. Just what per cent of the damage is done by these enemies cannot be ascertained but no doubt it is considerable.

The large wharf rat is found in considerable numbers in some places, staying, during the day, in rude nests built in the thick tangle of grapevine, where this grows, and elsewhere in the forks and hollows of trees. From here they issue at nightfall and begin their ravages. In the morning, perhaps, one will find a nest with young still in it, but each and every one with the skull broken open and the brains eaten out. At times this will be the only part of the bird eaten, at others the whole body will be knawed in pieces—which method of eating is characteristic of those rodents, that occasionally indulge in a carnivorous diet. Examination of the stomach contents throws practically no light on the food eaten by the rats, as they prey at night, and by the time they are gotten in the morning it is impossible to distinguish anything definite, even so far as to state whether or not they have been guilty of an avian diet. But that they certainly do destroy eggs and birds can be seen from the characteristic remnants that they leave.

Doves have always been the symbol of gentleness and submission, yet when it comes to the point of defence they are generally brave and often daring. They will stay by the nest to the last minute, then fly off with a great flutter, affecting a broken wing and trying their best to decoy the intruder. If no notice is taken of their first attempt they will return, and with a few flaps of the wing lie sprawled out on a nearby limb. When attacked by a small animal they will wait till it gets within range, and then with a puffing sound made in the mouth, strike out with the wing. These wing blows may be repeated in quick succession and, no doubt, are quite effective in warding off trespassers.

Dove hunting is considered good sport, especially where they occur in large numbers. They are quick and strong of wing, and extremely "gamy," all of which adds to the true hunting spirit. As they return from the north in the fall of the year they

assemble in flocks, sometimes containing "many thousands of individuals," and to a man who has any genuine hunting spirit it is not easy to resist the temptation to indulge in a little sport. Dove hunting, before the laws of 1908 went into effect, was generally practiced late in the afternoon up to about half an hour after sunset, during which time the birds are returning to their roosting places. Their flesh is considered a delicacy, and is preferred by those who can get both to that of quail.

Most of the states now offer partial or complete protection to doves. The latter in those states where they are not found in sufficient numbers to warrant good hunting; and partial where they are hunted as a game bird. In the latter case, protection varies in the several states. New Mexico has a closed season of only two and one-half months, i. e., from May 1 to July 15, while Colorado gives but twenty days of open season. This variation is much to be regretted, if for no other reason than that it gives an unfair advantage to the residents of those states where the season opens earlier and where there are no sale or export laws prohibiting shipments to other states. Uniformity of all fish and game laws, especially in states that are neighboring, should be secured, since it would simplify to a large extent the complications now arising in the exporting and importing of game. Above all, game birds especially ought to be protected throughout the breeding season, and even till the young have attained mature size. The following table, compiled from the laws of the several states, shows at a glance the variation of the laws. In some states, Arkansas, Maryland, North Carolina, South Dakota, each county has its own closed and open seasons, in some of which, although the state allows an open season, the county does not. In these, also, the legitimate number that can be killed by any one person in a day varies in the several counties. The limits allowed in the different states ranges from six in Maryland to thirty in Tennessee, while some ascribe no limit further than to restrict the hunting by entirely prohibiting the sale of game birds.

TABLE.

STATE.	CLOSED SEASON.	LIMIT.
Alabama	March 1-November 1	25
Arizona	March 1-October 15	A
Arkansas	State, A; B	..
California	October 15-July 15	25
Colorado	September 5-August 15	25
Connecticut	A	..
Delaware	A	..
Washington, D.	C	..
Florida	March 1-November 1	A
Georgia	March 15-September 15	A
Idaho	December 1-September 1	12
Illinois	December 1-August 1	15
Indiana	C	..
Indian Territory	F	..
Iowa	C	..
Kansas	September 15-August 1	A
Kentucky	February 1-August 1	A
Louisiana	March 1-September 1	25
Maine	C	..
Maryland	December 24-August 15	D, B, E
Massachusetts	C	..
Michigan	Closed till 1910	..
Minnesota	November 1-September 1	15
Mississippi	March 1-August 1	A
Missouri	January 1-August 1	A
Montana	December 1-September 1	10
Nebraska	December 1-Sept. 15	E
Nevada	A	..
New Hampshire	C	..
New Jersey	C	..
New Mexico	May 1-July 15	A
New York	C	..
North Carolina	March 1-November 1	A
North Dakota	A	..
Ohio	December 5-September 1	12
Oklahoma	January 1-August 1	E
Pennsylvania	January 1-September 1	10
Rhode Island	C	..
South Carolina	From April 1-Nov. 1 and from March 1-Nov. 15	B, D
South Dakota	A	..
Tennessee	April 15-August 1	30
Texas	Feb. 1-November 1	25
Utah	December 1-August 1	8
Vermont	C	..
Virginia	C	..
West Virginia	C	..
Wisconsin	C	..

A—No mention. B—County closed season; C—Closed all the year. D—Special limit in counties. E—For food only. F—Closed to all except Indians, to whom it is always open.

Economically, the amount of food eaten by birds in general is enormous, and it is but recently that this has been realized. Wilson, in estimating the daily food consumption of the flock observed by him, as mentioned in the introduction, says: "Computing each of them to consume one-half pint of mast daily, the whole quantity, at this rate, would equal 17,424 bushels per day. Heaven has wisely and graciously given to these birds rapidity of



flight and a disposition to range over vast uncultivated tracts of the earth; otherwise they must have perished in the districts where they resided, or devoured the whole products of agriculture as well as those of the forest."

From an economic standpoint, aside from the fact that they are hunted as game, doves are of interest to the farmer in relation to the quantity and kind of feed consumed. Like pigeons, they wander far from home during the day, and thus cover a large tract of territory, choosing their feeding ground according to the kind and abundance of food. Their flight in passing to and from their feeding grounds is in pairs during the spring and summer, but in the fall they gather in flocks of eight to thirty or more. They do not fly high, but direct, making the shortest distance from one place to another, except in districts where there is considerable hunting, in which case they will make for the nearest trees, and, keeping just above the tops, yet following the line of woods, they pass on to the roosting places.

Doves raised by the writer have been found to eat between 75 per cent and 120 per cent of their own weight of food per day, from the time they are hatched up to the time they are three weeks old. From then on the amount lessens rapidly till they become adult, when they will eat but 7 per cent to 10 per cent of their own weight. The following table, one of several recorded by the writer, will give some idea of the relation between age, weight and food consumption during the life of a squab. The nest recorded in the table was taken on May 7, 1908, the young then being three days old. It was visited on the afternoon of May 4, when one young had just been hatched, and was not yet dry, while the egg that remained had been picked nearly half way around. Consequently the difference in age between the two squabs was not more than a few hours. The uniformity in size and weight, which continued throughout growth, of these two, is remarkable in that it is unusual. The table shows the total amount fed each day, which was divided between two feedings, morning and evening. The birds were not crammed with food, but were allowed to eat all they wished. Although this is the record of birds raised in the house, and not under natural conditions, yet it seems as if it cannot help but show approximately, at least, the relations as found in nature.

TABLE.

Nest No. 3. Taken May 7, 1908. Young then three days old.

		Weight 6:00 a. m., before feeding,		Gain in twenty-four hours,		Weight of food eaten in twenty-four hours,	
		grams.	grams.	grams.	grams.	grams.	grams.
May	7.....	11.5	12	0	0	8	10.5
May	8.....	13	12.5	1.5	.5	8.5	8.5
May	9.....	15.5	13	2.5	1.5	9	10.5
May	10.....	16	13	.5	0	9	9.5
May	11.....	17	14	1	1	10.5	9
May	12.....	18	16	1	2	9	13.5
May	13.....	20	17.5	2	1.5	12.5	12
May	14.....	21.5	19	1.5	1.5	15	17.5
May	15.....	22.5	22.5	1	3.5	17	17
May	16.....	24	23	1.5	.5	13.5	20
May	17.....	26	26	2	3	20.5	22
May	18.....	28	28.5	2	2.5	21.5	18
May	19.....	29.5	31.5	1.5	3	25	23
May	20.....	31	34	1.5	2.5	27	24
May	21.....	33.5	37.5	2.5	3.5	27.5	28.5
May	22.....	39	42	5.5	4.5	23	23.5
May	23.....	42	47.5	3	5.5	20.5	25
May	24.....	45.5	51	3.5	3.5	25.5	18
May	25.....	50	57	4.5	6	22	23.5
May	26.....	59	61	9	4	22	24
May	27.....	65	67	6	6	23	21.5
May	28.....	70.5	70.5	5.5	3.5	20.5	20
May	29.....	75	74.5	4.5	4	15.5	18.5
May	30.....	81	79	6	4.5	19	14.5
May	31.....	85	84	4	5	16.5	22
June	1.....	87.5	89	2.5	5	13.5	19
June	2.....	90.5	92.5	3	3.5	17.5	15
June	3.....	93.5	96	3	3.5	17	18
June	4.....	96	98	2.5	2	16	13.5
June	5.....	96	99.5	0	1.5	14.5	16
June	6.....	96.5	100	.5	.5	15	19
June	7.....	97	100	.5	0	10	14
June	8.....	98	99	1	—1	15	12.5
June	9.....	98	101.5	0	2.5	13	15
June	10.....	98	101	.5	—5	14	12

As stated above, adult doves kept in the house consume but a small per cent of their weight of food per day. This is, of course, for birds that are more or less inactive, being confined in a large cage. There can be no doubt but that in the wild state they would eat considerably more, probably as high as 15 per cent or even 20 per cent of their own weight.

Doves shot in the afternoon have been found to contain food in the crop and gizzard amounting to nearly 20 per cent of the entire weight. This, of course, does not include food eaten in the forenoon and which had been digested.

Let us now consider the approximate annual consumption of a pair of doves. An adult weighs about 110 grams, this being the average of a considerable number; and it is safe to say that in nature they consume daily at least 15 per cent of this weight in food. On this basis it would take 33 grams a day to maintain a pair of doves; which, allowing an average of 30 grams a day for food fed to the young during six weeks of the summer, amounts to over 30 pounds a year; at which rate it would take but 66 pairs to consume a ton of feed a year. And one can readily see that this in itself must count for something in the economy of nature. These figures are taken by comparing the food records of birds kept in cages, together with crop and gizzard contents of those shot wild. In determining the proportionate weight of food eaten, the doves are weighed as they are brought in from the hunt. The crop and gizzard contents are computed after these have been dried and the mineral matter as far as possible been separated. Thus we are able to determine approximately the actual weight of seeds and grain as they are picked up by the birds. Of course, this is not near exact, since the doves are only gotten in the afternoon, and there is no way of determining the amount of food that has been previously digested. The figures, as given, are rather low than otherwise.

Let us now consider whether this enormous amount consumed by the doves annually is detrimental, neutral or beneficial to the farmers of the country. It is to be regretted that tables are not available which show the varieties of seeds eaten by these birds and the relative amounts of each. Data collected in this vicinity is not sufficient to warrant any definite statements. It can, however, be said from what little information has been gotten

by an examination of the crop and gizzard contents of a good many individuals, that weed seeds are preferred to all other kinds of food, and the smaller varieties to the larger. Rice and other domestic grains, together with the seeds of forage plants, and even corn are eaten, but in very inconsiderable quantities compared with weed seeds and wild berries of various kinds. In lieu of other data the writer has taken the liberty to quote from others whose statements do not lack in authority and are corroborated by observations in this locality. The varieties of seeds, of course, differ, since the flora is not the same in any two parts of the country; yet it is a fact that doves destroy the injurious plant seeds rather than the harmless and useful, which is the important thing and not the specific species.

T. S. Palmer of the United States Biological Survey (Bull. No. 12, U. S. Dept. Agri.) states in regard to the food of doves: "Doves feed largely on seeds, and an examination of a considerable number of stomachs has shown that this includes seeds of the noxious weeds, such as poke weed and several varieties of the genus *Lithospermum* (Gromwell, Puccoons, etc.), *Oxalis* (Sorrel), and *Euphorbia* (Spurge). In certain parts of California the habit of feeding on the seed of the turkey mullein (*Eremocarpus setigerous*) is so well known that a botanist, on inquiring how he could collect some seeds of the plant, was advised to shoot a few doves and open their crops. Under certain circumstances enormous quantities of weed seeds are devoured, as shown by the crop of a dove killed in a rye field at Warner, Tenn., which contained no less than 7,500 seeds of *Oxalis stricta*. As a weed destroyer, it more than compensates for the grain that it occasionally consumes, and the value of its services is certainly greater than the few cents that its body brings in the market." Sylvester Judd, also of the United States Biological Survey (Year Book of the Dept. Agri., 1900), speaking of the food of nesting birds, says: "Five squabs of the mourning dove were examined in the laboratory of the Biological Survey; 30 per cent of their feed was composed of the seeds of the sorrel (*Oxalis*), spurge, ragweed, sunflower, pigeon-grass and corn, while the remaining 70 per cent consisted of irregular endosperm fragments of the above seeds from 0.5 mm. to 3 mm. in diameter, probably the regurgitated matter known as pigeon's milk. Adult doves collected during the breeding season, had eaten the same kind of seeds.

together with that of the Violet *Polygonum*, buckwheat and wheat. One dove, which had recently left the nest, had in its crop 7,500 seeds of the yellow sorrel (*Oxalis stricta*.)”

From the foregoing statements of biologists, and the few notes made in Cameron parish, there can be no doubt but that doves throughout the country must consume annually many tons of weed seed which, if left on the ground, would give just so much more chance for weeds to sprout out and become obnoxious to the farmer, who probably suffers more from their injurious effects than from any one of his numerous other enemies. To quote from W. L. McAtee (Bull. 23, Bio. Sur.): “They rob the soil of its nutritive elements and of its moisture, and thus reduce the size of the crops. They are most hardy, vigorous plants, and choke out the more delicate plants of cultivation. Many fungus diseases of cereal, fruit and other crops, such as rusts and rots, depend upon their continuance upon weeds as intermediate hosts. Such weeds as mustards are especially well known as the primary basis of rusts. . . . The damage they cause, reckoned in dollars and cents, is enormous. The botanist of the department says, ‘The direct loss in crops, the damage to machinery and stock, and the decrease in the value of the land due to weeds, amount without question to tens of millions of dollars each year, a loss sustained almost entirely by the farmers of the nation.’”

Weeds, as a rule, produce far more seeds than do cultivated plants, a single one often producing thousands. The common fextail, for example, has been known to produce 113,000 seeds per plant, and the Tumble weed as high as 115,000; multiply this by the thousands of these plants in existence, and again by the hundreds of species of other varieties found in any one locality, and one can get some idea as to the number of seeds that are annually matured.

As stated above, the percentage of domestic grain eaten by doves is small, yet the amount must be considerable in localities where these birds are found in large numbers; but we must not overlook the fact that they gather their food, with the exception of a few wild berries, wholly on the ground, and never pluck the kernel from the stalks, eating only what grain falls to the ground and which, therefore, cannot be utilized, becoming practically

waste. The damage done to seed sown broadcast for the ensuing crop may be considered of more importance, and which, combined with the ravages of other birds, causes some ill-will against them. Yet it must be taken into account that if the weed seeds that are eaten together with the grain, were not destroyed, but allowed to grow, they would choke out far more plants than there were grain seeds eaten, stunting many others.

Ignorance of the habits of birds and other animals has often led to an unjust criticism. This has been shown time and again, most noticeably, perhaps, in the case of hawks and owls, which at one time were all considered detrimental, owing to the fact that they occasionally helped themselves to chickens, other barnyard fowls, and especially game birds. Yet, as has been shown most conclusively by Dr. A. K. Fisher in his excellent work on "The Hawks and Owls of the United States in their relation to Agriculture," with three exceptions, the Sharp-shinned, Cooper's and Goss Hawk, none of our hawks and owls are to be, and but few may be, condemned, while many are far more beneficial than injurious. By some industrious farmers the doves are accused of being the cause of weed-seed distribution and on this account are shot down when found foraging in the grain fields where the farmer has spent much time in improving the land. In these cases the farmers believe that the weed seeds are eaten and that they pass through the digestive organs of a dove without any detrimental effect upon the life of the seed. Although this is true in many other birds, for example the Mocking bird, it can by no means be said of doves. E. T. Lovell, of Crowley, says: "The doves visit the rice fields by the hundreds, if not thousands, in the fall, yet but few complaints are made against them for *eating rice*. The farmers do, however, complain about their scattering the seeds of the indigo weed (a great nuisance in the rice fields) which they think is done by the dropping of the seeds with the excrement after having passed through the body intact. On this account they are often shot and driven from the fields."

This practice of shooting doves for an unjust cause should be, and undoubtedly would be, stopped by any reasonable farmer when the facts in the case are known. Food in the shape of grains and seeds is swallowed whole. It remains for some time in the crop, which, as stated before, is very capacious, and is there softened somewhat by digestive fluids; it then passes to the gizzard, which is large and very powerful. In it is found a certain

quantity of sands, shells and other solid mineral matter, amounting often to more than 6 per cent of the gizzard contents. By means of the powerful muscles and sharp-edged sand grains, shell, etc., the food is ground to a fine pulp; even the tough outer casing of most seeds is reduced to an extremely fine sort of bran. After passing through the gizzard, the nutritive elements are absorbed and the indigestible matter, together with the seed bran, is excreted. The digestive organs of a dove are such that it is impossible for a grain or seed of any kind to pass through the body and not have the germ of its life destroyed.

We thus see that perhaps the main accusation laid against the doves is utterly unjust; and the worst that can be said against them is that they do not eat some of the seed that is sown broadcast where it lies on the ground uncovered; but even here the damage is slight and can be readily obviated, to some extent, by bushing or drilling in the seed. They do, however, like the meadow lark and some other birds, probe the ground with their bills and scatter the surface to one side, picking up such grain as may then be exposed. Yet this habit is not practiced continually while feeding, and so the damage done is not great and is but little worthy of consideration.

The conclusion, then, is obvious—namely, that doves are wholly beneficial to man. The useful grains eaten are of little or no value to the farmer, they being necessarily waste, and may, therefore, be considered neutral in their effect upon the economy of the farm. Seeds of plants, neither useful nor harmful, are taken more frequently, but these in themselves have no effect, direct or otherwise, if left or destroyed. But as weed-seed destroyers they take an important place, consuming immense quantities of these pests-in-the-germ.

Man may be able to destroy the seeds after they sprout, and each plant eliminated means thousands of seeds destroyed, but what can he do to get rid of the tons of weed seed that are produced annually and may be scattered over his district? What means can he adopt that will more effectually keep in check the rank growth of weeds that eat up the nourishment of the soil than to spare those birds that will destroy them in the germ? Among such birds the farmer may depend on the doves. Let the question be put in another form: Can 66 pairs of doves, at highest market price, compensate for the value of a ton of weed seed destroyed?

SUMMARY.

Doves, though not equally abundant in all places, are found throughout the United States, migrating each spring and fall. The breeding season begins, in the South, about April 1, being a month later in the North, and lasts through September, both in the North and South. Two, or sometimes three, broods are raised, each brood requiring at least six weeks to rear. The young are fed generally but twice a day, and the parents wander far to forage for food, which consists exclusively of seeds, berries and grain. Mature size is acquired in five or six weeks at the most. Change in plumage begins between the seventh and eighth weeks; the time of molting varies according to the physical condition of the individual. Enemies, at least in certain localities, are numerous, as evidenced by the fact that but few young mature, compared with the number of eggs laid. Their numbers in certain parts are such as to be of some importance in the economy of nature, while as a game bird they are of no small value.

Through man's agency, doves have diminished in numbers to a point where they are of little commercial importance; yet through legislation, rigidly enforced, they will soon increase and may become of great value. No two states in the Union have uniform bird laws, and hardly two in which doves are protected alike. The present laws, if strictly carried out and respected by hunters would, no doubt, be sufficient, but much more is to be gained by uniformity, combined with rigid enforcement. Doves need to be protected as much as any other game or insectivorous bird, in that they are beneficial to the farmers of our land, besides being an important game bird in certain sections. The closed season ought to be, as is the case in all states in regard to partridges and quail, extend over the breeding season, allowing the adult a fair chance to rear their young.

THE RAISING OF YOUNG *AMPELIS CEDRORUM*.

NOTE.—The following is one of the several experiments that have been made by the author with the idea of raising young birds to an adult state, as normally as possible, under changed environment, having in mind the ultimate object of noting the results of artificial and no training on the song of birds which had been taken from their natural element. For this purpose, the following species of birds have been raised by hand, from the time they were one, two or three days old: Wax-wings,

Ampelis cedrorum; sparrows, *Melospiza fasciata* and *Spizella socialis*; warblers, *Geothlypis trichas*; thrushes, *Merula migratoria*, and incidentally, also, hawks, *Accipiter velox*; and owls, *Megascops asio*. The first mentioned grew to maturity in the normal length of time, being fourteen days in the nest and three days out of it before they were left to care for themselves entirely. For this reason I shall mention observations on these principally.

On July 19 a pair of wax-wings were seen alternately tugging at the frilled end of a rope that was hanging in a maple tree. They were watched, and it was found that a nest had already been nearly completed in an apple tree about thirty feet from the house. From a window on the second floor the nest could be plainly seen and closely watched with a pair of field glasses. The first egg was laid on July 21, early in the morning; another was laid the next day, and so on, until the afternoon of the sixth day, when the set was complete, consisting of five eggs. Incubation was begun on July 24, when for the first time the female, probably, was observed sitting on the nest continuously all day. It is practically impossible to tell the sexes apart, but it is likely that it was she that attended principally to the hatching of the eggs, and that it was he that took share for short intervals only, but frequently bringing food for his mate, which consisted chiefly of berries of one kind or another.

On the morning of August 6 one naked body was seen in the nest, and by the evening of the next day four of the eggs had hatched; the fifth, as being found later, being infertile. Feeding of the young began very soon after hatching, within three or four hours. Yet both of the birds brooded over the young for some while after each feeding; so the young were never left for more than a few minutes at a time. As far as could be seen the young were fed on berries, although later it was found that insects were added to the diet. The food was carried in the crop, and when this was apparently full an additional one would occasionally be held in the mouth. The young were fed as in other Passerine birds, except that the food is first swallowed by the parent, and it is then regurgitated and fed piecemeal and not in bulk, as in the case of the pigeon.

After feeding, in which act both birds take an equal share, the parent stands over the young ready to perform the sanitary duties of the nest. The excreta, which is held together in a more

or less firm mass by a tough jelly-like substance, is almost invariably swallowed by the old bird; but it is probable that it is regurgitated and thrown out after leaving the nest, since it seems likely that, if left in the crop, it would become mixed with the food that is gathered immediately after. If the volume of excreta swallowed were small it would not necessarily be ejected, but since the amount is often nearly equal to the quantity fed, sometimes as high as 75 per cent, and since the feeding is done by a regurgitating act, the waste matter must be thrown out. No direct observation could be gotten on this point, for immediately upon leaving the nest the bird would fly a considerable distance, very seldom stopping even within sight.

On the evening of August 9, after dark, the entire nest was taken from the tree into the house. At this time one bird had opened its eyes a mere slit, while the rest had not even had a peep of the world. The young were left in the nest and covered with the skin of a flying-squirrel to keep them warm.

The next morning the first meal given them consisted of crackers soaked in a raw egg. The excreta from all four little birds at this time was examined, in order to determine more exactly what had been fed by the adults the day before. In it were found the seeds of blue huckle berries and raspberries; the stones of two wild cherries, the elytra, cuticle and pieces of the wings of several beetles.

The first two days they were fed at least once every hour up to 7 in the evening, when they were put in a warm corner and covered for the night. From the third to the seventh day of keeping they were fed every two hours or so, and after that every three hours until they were ready to leave the nest.

With the exception of Gallanaceous and a few Raptorian birds, the young require quantity rather than quality of food; for it passes through the digestive tract very rapidly and only a small amount is really absorbed. Often a small blueberry or kernel of boiled rice would pass through intact. The length of time that food is kept in the digestive tract varies in young Passerine birds directly with the feeding periods. The undigested particles from one feeding would not be excreted till the second, third or fourth feeding after. The waste matter from the evening would be all excreted at the first or second feeding in the morning. If, however, food is given them at very short intervals, say three to five minutes, undigested matter is often excreted within fifteen or twenty minutes from the time

it is given. This may vary also with the character of the food. Fruits, berries and greens pass through in about one-half the time required for hoiled rice, crackers, eggs, and the like. Yet, even these are never retained long enough to be more than half digested.

Observations of this kind were easily gotten by giving each time only the following varieties of food: Crackers, soaked in raw egg or milk; raspberries, boiled rice, crushed blue or huckle berries, and hard boiled eggs. Occasionally these were varied and others added for the day. It was found that rice was liable to cause constipation, and so it was sometimes mixed with crushed sweet apple, lettuce, or grass cut up fine. Seeds and ground grain, as Indian meal, were little, if any, digested. Like all other birds, these require a certain amount of mineral matter which is supplied in the natural state by the cuticle of insects, or dirt that is in them or gotten with them. To make up this deficiency in artificial raising, and to keep the digestive tract in a healthy condition, it was found that plain dirt or fine sand answered the purpose as well as anything. Accordingly, a small quantity of it was mixed with their food two or three times a day. If, however, this was not sufficient, ground shells were added. The young of birds do not require any water. The moisture in most foods, combined with the saliva from the parent's mouth is sufficient until they are old enough to fly and eat of their own accord.

The food of a bird is, to a certain extent, an acquired characteristic, and birds can be taught to eat things that are entirely unnatural to them. As, for example, a young robin that had been raised on soft food was placed, as soon as it was old enough to feed itself, in company with an adult chipping sparrow caught when full grown. Soft food for the robin and seeds for the sparrow were kept in separate dishes inside the cage. The robin being young naturally imitated the sparrow and took to eating seeds. Later it seemed to prefer these to the softer foods and finally it was fed entirely on them.

Some interesting data was gotten in regard to the rate of growth as compared with the amount of food taken. It was not convenient to weigh each individually and compare it with the amount of food given it; so the plan was followed of weighing the total quantity of food eaten at each meal and comparing the total daily quantity consumed with the gain in weight from day to day. The following is the total amount eaten daily as com-

pared with their combined weights: First day, 1.0 of their own weight; second day, 1.1; third day, 1.3; fourth day, 1.7; fifth day, 1.5; sixth day, 1.3; seventh day, 1.2; eighth day, 1.0; ninth day, .9; tenth day, .9; eleventh day, .7; or, in other words, the average eaten during each of the eleven days was 1.107 of their own weight. The comparative quantity eaten after the birds are seven or eight days old, considering them as three days old when gotten, thus diminishes as seen above. As adults, they will eat between .2 and .4 of their own weight, depending somewhat upon the quality of food given, highly nutritious foods being eaten in smaller quantities. The average daily rate of growth for the eleven days was about .2 of the amount of food taken.

Warmth is quite essential in the raising of young birds. If they become chilled thoroughly when young, it may retard the growth several days or stunt it entirely, as was the case with a half-grown robin which for two weeks gained only five grams and never attained normal size. Direct sunlight was found to be too hot and would cause birds to pant, but if shaded with a piece of loose basket-work they seemed to receive the desired amount of warmth. For covering at night, a piece of flannel proved to be as satisfactory as anything. I generally used a piece of skin of a flying-squirrel.

Like the young of other birds, when overheated the *Ampelidae* spread their wings and stretch out their necks against the sides of the nest, but fold their feathers tightly. When cold, these young birds in the nest lie facing each other; when warm, they lie indifferently; and when overheated lie facing away from each other.

Cleanliness is next to feeding in importance. It is no use trying to get young birds to grow normally unless they are kept absolutely clean. A filthy or even dirty nest is never found in nature, the parent birds removing every bit of foreign matter that it liable to foul it. In spite of all efforts, it is next to impossible to keep a nest absolutely clean, when kept in the house, for more than two or three days at a time; especially if the young are not entirely healthy and the functions of excretion occur irregularly, instead of at feeding time. Berry boxes, half filled with hay, with a layer of fine excelsior on top, proved to be quite satisfactory as an artificial nest. The nest should not be deeper than is necessary to keep the young birds together, and warm. The nesting was generally changed once a day by removing the excelsior and adding fresh excelsior. For disinfection and to prevent

parasites, the berry box was placed in a larger box, which was filled to about one-half the height of the smaller box with dry sand and kept lice proof and antiseptic by a mixture of insect powder and powdered bichloride of mercury.

As soon as the wax-wings were able to support themselves on their wings, which was August 20, they were taken from the nest and placed in a large, shallow box, with perches, and without cover. That night two of them died, for some unknown reason. The others, however, continued to be fed the same as usual and seemed to be contented in their coverless box, not even attempting to move much from perch to perch until the second day. On the third day they were left alone most of the time, being fed by hand only twice; while on August 23 they were left to care for themselves.

Although young birds will sooner or later learn to prune their feathers, the habit is very easily taught by rolling a bit of cotton loosely on a stick and rubbing it over the body in such a way that the fibres will catch on the rough edges of the feathers. In this manner the young birds were taught to make attempts at pruning when but six days old.

Being always fed in silence, they came to regard most sounds as suspicious. At a whistle or peep, they would down the crest feathers and listen. Yet they had no fear in the real sense. Strange objects seemed to affect them but little, and they could be carried anywhere, perched on a finger. If loose in the room, they would fly towards any person that came in. The instinct of fear was not developed so long as they were kept in the house, and they would even allow petting and handling with indifference. But that fear was present, though latent, was shown after the birds had been placed in a large cage and hung in a tree in the orchard; when, inside of a week, they were as wild as any bird, becoming excited whenever anyone came near.

One other strong innate instinct is that of migration, this being the most difficult period through which to keep a young bird, and I have always found it best to liberate them before this time if I did not want them to die in the cage. As soon as the crisp days of fall set in, the bird feels a new emotion. A state of restlessness seizes it, and it wants to get away. Now for the first time it feels the limitations of the cage and longs for the wide expanse. Nothing will content it, and as the days grow shorter it pines away, eating less and less, gradually losing its spirit and activity, until fate steps in and cuts the cord.



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